Feb 2026

Stormwater Management Report (Functional-Storage Requirements)

Proposed Mixed-Use Development

2415 Cabana Road E, 2385 Cabana Road E, 2375 Cabana Road E, 4040 Walker Rd, Pt. of 4096-4128 Walker Rd, 0 Cabana Rd and 0 Cabana Rd E

Windsor, Ontario

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1 Executive Summary

This functional-level Stormwater Management (SWM) Report has been prepared to support the proposed redevelopment of a mixed-use development located at 2415 Cabana Road East, 2385 Cabana Road East, 2375 Cabana Road East, 4040 Walker Road, portions of 4096–4128 Walker Road, 0 Cabana Road, and 0 Cabana Road East, at the intersection of Cabana Road and Walker Road in the City of Windsor, Ontario.

The purpose of this report is to demonstrate, at a functional planning level, that post-development stormwater runoff can be appropriately managed in principle, in accordance with the City of Windsor stormwater management requirements and the Windsor/Essex Region Stormwater Management Standards Manual (WERSM), to support planning and zoning approvals.

Stormwater quantity analysis was completed using the Rational Method with a 10-minute critical duration and City-accepted rainfall data. This approach is considered appropriate for screening-level analysis at the functional planning stage. Existing site conditions consist of a combination of grassed, gravel, and paved surfaces, while post-development conditions reflect a predominantly impervious mixed-use development.

For functional planning purposes, the 2-year storm event has been identified as the governing minor system control event, consistent with typical municipal drain practice and subject to confirmation by the City of Windsor. Post-development discharge is anticipated to be restricted to the pre-development 2-year peak runoff rate. Minor system storage requirements are intended to be accommodated through on-site detention, primarily within underground storage components, while surface ponding is considered part of the major system only.

Larger storm events, including the 5-year and 100-year storms, have been reviewed at a functional level to assess major system conveyance, surface ponding, and overland flow routing. Storage volumes associated with these events are provided for major system screening purposes and do not represent governing quantity control requirements.

Climate change considerations have been addressed in accordance with the Windsor/Essex Region Stormwater Management Standards Manual (WERSM). The 150 mm Urban Stress Test is recognized as a system vulnerability and resiliency assessment, and a detailed stress test evaluation, including confirmation of governing water levels and potential mitigation measures if required, will be completed at the Site Plan and detailed design stage, once final grading, drainage routing, and outlet controls are established.

The results of this functional-level assessment demonstrate that the proposed stormwater management approach is technically feasible and appropriate to support planning and zoning approvals. Final design details, including hydraulic routing, grading refinement, outlet control sizing, and confirmation of tailwater conditions, will be completed during the detailed design and Site Plan approval stage, in consultation with the City of Windsor and applicable agencies.

2 Introduction

This Stormwater Management (SWM) Report has been prepared at a functional planning level to support the proposed mixed-use development and the associated planning and zoning applications. The purpose of this report is to provide screening-level estimates of stormwater runoff rates and preliminary on-site storage requirements in order to assess the feasibility of stormwater management for the subject site, in accordance with the City of Windsor requirements and the Windsor/Essex Region Stormwater Management Standards Manual (WERSM).

The analyses presented herein are conceptual in nature and are intended to support the Official Plan Amendment and Zoning By-law Amendment applications. Consistent with WERSM guidance for zoning-level submissions, detailed stormwater management design—including hydraulic routing and modelling, outlet control sizing, grading refinement, and confirmation of flood and tailwater conditions—will be completed at the Site Plan and detailed design stage, in consultation with the City of Windsor and applicable approval agencies.

This functional-level assessment includes a comparison of pre- and post-development runoff conditions, confirmation of stormwater quantity control requirements for the minor system, identification of estimated on-site storage requirements, and a screening-level review of major system performance and climate change considerations, including the Urban Stress Test. The findings of this report are intended to support planning approvals and will be refined and confirmed during detailed design.

3 Design Criteria

Stormwater quantity management for the subject site has been evaluated based on the following criteria and guidelines:

- The Windsor/Essex Region Stormwater Management Standards Manual
- The Ministry of the Environment (MECP) Stormwater Management Planning and Design Manual
- Functional Servicing and Stormwater Management submission requirements

3.1 Quantity Control Requirement

For functional planning purposes, the 2-year storm event has been identified as the governing minor system quantity control event, consistent with typical City of Windsor practice for developments discharging to municipal drainage infrastructure. Post-development discharge is anticipated to be restricted to the pre-development 2-year peak runoff rate, subject to confirmation by the City of Windsor at the Site Plan stage.

Pre-development runoff rates have been estimated using the Rational Method with a 10-minute critical duration for screening-level analysis. This assumption is appropriate at the zoning stage and will be refined through detailed time-of-concentration calculations and hydraulic routing during detailed design, in accordance with WERSM methodology.

3.2 Major System Events

The 5-year and 100-year storm events have been reviewed at a conceptual level to assess major system conveyance, surface ponding, and overland flow routing.

These storm events are not intended to govern minor system quantity control, but must be safely accommodated on-site without adverse impacts to adjacent lands or downstream infrastructure. Storage volumes and system performance associated with these events are presented for major system screening purposes only and will be confirmed and refined through detailed grading and hydraulic analysis at the Site Plan and detailed design stage.

3.3 Climate Change / Urban Stress Test

At the functional planning level, stormwater quantity control has been assessed using historical Intensity-Duration-Frequency (IDF) data, consistent with City of Windsor practice.

A screening-level Urban Stress Test, consisting of a 39% increase in rainfall intensity, has been considered to qualitatively assess overall system robustness under future climate conditions. This assessment is intended for high-level planning review only and does not represent a governing design standard. The 39% rainfall increase is provided for qualitative screening only and does not replace the WERSM-required 150 mm stress test.

In accordance with the Windsor/Essex Region Stormwater Management Standards Manual (WERSM**)**, a 150 mm rainfall stress test is required to evaluate system vulnerability and resiliency, including surface ponding depths, overland flow routes, and potential impacts to critical infrastructure and lowest building openings. A detailed 150 mm climate change stress test, including confirmation of governing water levels and identification of mitigation measures if required, will be completed at the Site Plan and detailed design stage, once final grading, drainage routing, and outlet controls are established.

4 Site Description

This Stormwater Management (SWM) Report addresses the proposed redevelopment of a mixed-use development located at 2415 Cabana Road East, 2385 Cabana Road East, 2375 Cabana Road East, 4040 Walker Road, portions of 4096–4128 Walker Road, 0 Cabana Road, and 0 Cabana Road East, at the intersection of Cabana Road and Walker Road in the City of Windsor, Ontario.

The subject site has an approximate area of 73,061.38 m² (7.31 hectares) and currently consists of a combination of grassed, gravel, and paved surfaces. The proposed redevelopment includes multiple buildings comprising a mix of commercial and residential uses, along with associated parking, access, and servicing infrastructure.
The proposed development program is summarized as follows:

- Building A: 1,049 m² of commercial space and 44 residential units
- Building B: 1,010 m² of commercial space and 30 residential units
- Building C: 797 m² of commercial space
- Building D: 5,213 m² of commercial space
- Building E: 4,563 m² of commercial space
- Building F: 1,046 m² of commercial space
- Building G: 3,982 m² of commercial space

The total gross building area for the proposed development is approximately 17,654 m².

A total of 956 parking spaces is proposed to support the mixed-use development. The distribution of parking spaces by building is summarized below:

- Building A: 113 spaces
- Building B: 81 spaces
- Building C: 40 spaces
- Building D: 232 spaces
- Building E: 223 spaces
- Building F: 87 spaces
- Building G: 180 spaces

Parking requirements have been determined based on the following preliminary criteria:

- 1 parking space per 22.5 m² of commercial gross floor area
- 1.25 parking spaces per residential unit for mixed-use buildings

5 Existing Site Conditions

5.1 Site Location

The proposed development site is located at the southeast corner of Cabana Road East and Walker Road in the City of Windsor, Ontario. The site encompasses an area of approximately 7.31 hectares (73,061.38 m²).

Figure 5.1 – Site Location

5.2 Existing Grading and Landform

The subject site has an approximate area of 73,061.38 m² (7.31 hectares) and is currently comprised of a combination of grassed, gravel, and paved surfaces.

Based on a review of available topographic survey information and existing drainage features, stormwater runoff from the site generally drains toward the surrounding municipal drainage infrastructure, including roadside ditches, open drains, and storm sewer systems along Cabana Road and Walker Road. Runoff is conveyed through existing surface flow paths and a series of catch basins and maintenance holes, consistent with the historical development pattern of the area.

The existing grading and drainage patterns described herein are provided for functional planning purposes only. Detailed confirmation of surface slopes, flow directions, and low points will be completed at the Site Plan and detailed design stage.

5.3 Existing Infrastructure

Existing municipal infrastructure adjacent to and within the site has been reviewed at a functional level to support the assessment of stormwater management feasibility for the proposed redevelopment. The following summarizes the key servicing infrastructure relevant to the subject lands.

5.4 Sanitary Sewer

Based on available municipal records, the site is serviced by the following existing sanitary sewer infrastructure:

- 250 mm diameter sanitary sewer along Cabana Road East
- 250 mm diameter sanitary sewer along Walker Road

The capacity and condition of the existing sanitary sewer system will be confirmed through separate detailed analysis.

5.5 Storm Sewer

The existing storm drainage system in the vicinity of the site includes the following infrastructure:

- 600 mm diameter storm sewer along Cabana Road East
- 675 mm to 750 mm diameter storm sewer along Walker Road
- Approximately 3000 mm × 1500 mm concrete box culvert traversing the site from Walker Road toward the adjacent railway corridor

The existing box culvert is understood to convey flows associated with the surrounding drainage area toward downstream municipal drainage infrastructure. The condition, hydraulic capacity, and tailwater influences associated with storm sewer will be reviewed and confirmed at the detailed design stage, as required.

5.6 Utilities

The site is currently serviced by a range of municipal and private utilities, including:

- Overhead and underground electrical (hydro) services
- Natural gas distribution infrastructure
- Street lighting along Cabana Road and Walker Road
- Telephone and cable infrastructure within the adjacent road allowances

The presence of existing utilities will be considered during detailed site servicing and grading design to ensure coordination and avoid conflicts.

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6 Surface Condition

6.1 Existing Surface Conditions

The existing surface condition breakdown for the subject site is summarized in Table 6-1.

Table 6-1: Existing Surface Condition Breakdown

Site Boundary Location	m^2	ha
Existing grass area	58,449.00	5.84
Existing gravel area	10,959.00	1.10
Existing Asphalt and Concrete area	3,653.00	0.37
Total Area	**73,061.00**	**7.31**

Based on a review of existing site conditions and available survey information, runoff from the existing site generally drains toward on-site catch basins located within the parking areas. Stormwater collected by these catch basins is conveyed to the municipal storm sewer system west of the property limits. Surface drainage at the property boundaries is generally directed toward these on-site collection points through existing grading and surface flow paths.

The existing surface condition information presented herein is intended for functional planning purposes only. Detailed confirmation of drainage flow paths, contributing areas, and surface slopes will be completed at the Site Plan and detailed design stage.

6.2 Proposed Surface Conditions

The proposed redevelopment will result in a revised distribution of surface conditions across the site. The proposed surface condition breakdown is summarized in Table 6-2.

Table 6-2: Proposed Surface Condition Breakdown

Location	m^2	ha
Proposed Landscaping green area	24,815.00	2.48
Proposed Building area	17,654.00	1.77
Proposed Asphalt Area	30,592.00	3.06
Total Area	**73,061.00**	**7.31**

The proposed surface conditions reflect a predominantly impervious mixed-use development, with impervious areas associated with building footprints and paved parking and access areas, and pervious areas associated with landscaped and green spaces.

The surface condition breakdown presented above has been used to support screening-level runoff and storage calculations for zoning and planning purposes. Final surface limits, drainage areas, and runoff coefficients will be refined and confirmed at the Site Plan and detailed design stage, following finalization of grading, building layout, and servicing design.

7 Stormwater Management Calculations

Stormwater runoff calculations have been completed at a functional planning level to estimate pre- and post-development peak runoff rates and to support screening-level storage requirement assessment, in accordance with the Windsor/Essex Region Stormwater Management Standards Manual (WERSM).

The calculations presented herein are intended to confirm stormwater management feasibility in principle for planning and zoning approvals. Detailed hydraulic modelling and routing will be completed at the Site Plan and detailed design stage, in consultation with the City of Windsor and applicable agencies.

7.1 Runoff Coefficient Selection

Runoff coefficients have been selected in accordance with WERSM guidance and reflect the existing and proposed surface conditions across the site.

For functional planning purposes, runoff coefficients are applied as area-weighted composite values to provide conservative, screening-level estimates of peak runoff. Final runoff coefficients will be refined at detailed design, following confirmation of final grading, drainage areas, and surface coverage.

Table 7.1 Typical Runoff Coefficient

Land Use	C value
Asphalt, concrete, roof areas	0.95
Gravel	0.70
Grass – sandy soil	0.15
Grass – clay soil	0.20
Residential – Single family	0.60
Residential – Single family (lot size 500 m² or less)	0.70
Residential – Semi-detached	0.70
Residential – Townhouse / Row housing	0.80
Industrial / Commercial	0.90

Typical runoff coefficients are provided above for reference, consistent with the Windsor/Essex Region Stormwater Management Standards Manual (WERSM). These values are intended to guide runoff coefficient selection based on surface characteristics and land use.

For the subject site, runoff coefficients have been selected based on the actual surface composition, including landscaped areas, gravel surfaces, roof areas, and paved areas, rather than generalized land use categories. Accordingly, the composite runoff coefficient adopted for functional planning purposes is considered reasonable and conservative. Final runoff coefficients will be confirmed at the Site Plan and detailed design stage following confirmation of grading, drainage areas, and surface coverage.

7.2 Rainfall Intensity (IDF) Parameter

Rainfall intensities were derived using the Windsor/Essex Region Stormwater Management Standards Manual, Table 3.2.1.1, and calculated using Equation 3.2.1.1, expressed as:

$$I = \frac{a}{(t+b)^c}$$

where:

- I = rainfall intensity (mm/hr)
- t = storm duration (minutes)
- a, b, c = IDF coefficients per WERSM

Windsor/Essex Stormwater Management Standards Manual, Table 3.2.1.1

Parameters	Return Period (Years)					
	2	5	10	25	50	100
a	854	1259	1511	1851	2114	2375
b	7.0	8.8	9.5	10.2	10.6	11.0
c	0.818	0.838	0.845	0.852	0.858	0.861

The Intensity of Rainfall without Stress Event

Duration	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
5	111.86	139.57	157.73	182.17	200.17	218.23
10	84.13	107.72	122.80	142.97	157.69	172.68
15	68.13	88.40	101.26	118.42	130.87	143.67
30	44.53	58.69	67.63	79.54	88.10	97.06
60	27.40	36.32	41.96	49.47	54.81	60.50
120	16.24	21.47	24.80	29.23	32.33	35.70
360	6.82	8.89	10.22	12.00	13.21	14.57
720	3.90	5.03	5.75	6.73	7.38	8.13
1440	2.22	2.83	3.22	3.75	4.10	4.50

7.3 Methodology – Peak Runoff Estimation

Peak runoff rates were calculated using the Rational Method, expressed as:

$$Q = C \times I \times A$$

where:

- Q = peak runoff rate (L/s)
- C = runoff coefficient
- I = rainfall intensity (mm/hr)
- A = drainage area (ha)

A 10-minute critical duration was adopted for functional planning and screening-level analysis. This assumption is considered appropriate at the zoning stage and will be refined through time-of-concentration calculations and hydraulic routing during detailed design, in accordance with WERSM Section 3.7.3.

7.4 Pre-Development Runoff Coefficient Calculations

7.4.1 Pre-Development Runoff Coefficient

Pre-development runoff conditions were evaluated based on the existing mix of grassed areas, gravel surfaces, and limited paved areas across the site.

A composite runoff coefficient of C = 0.31 was adopted for functional planning purposes. This value represents a weighted average of existing surface conditions and is considered reasonable and conservative for screening-level peak runoff estimation.

The selected runoff coefficient will be refined at detailed design, following confirmation of final grading and drainage patterns.

7.4.2 One-in-Two-Year Storm Event (Governing Minor System Event)

The 2-year storm event has been identified as the governing minor system control event for functional planning purposes.

- Pre-development 2-year peak runoff rate (10-minute duration): 533.56 L/s

This value represents the preliminary allowable release rate, subject to confirmation by the City of Windsor at the Site Plan stage

7.4.3 One-in-Five-Year Storm Event (Major System Screening)

The 5-year storm event has been evaluated at a screening level to assess major system conveyance and surface ponding behavior. This event does not govern minor system quantity control.

7.4.4 One-in-One-Hundred-Year Storm Event (Major System Screening)

The 100-year storm event has been reviewed at a screening level to assess major system conveyance, storage feasibility, and overland flow routing. Peak flows and storage volumes associated with this event are provided for major system assessment only and do not represent governing quantity control requirements.

One in Two Year Storm Event				
Time	**Intensity**	**Runoff Coefficient**	**Area**	**Flow**
min	mm/hr	C	ha	L/S
5	111.86	0.31	7.306	709.44
10	84.13	0.31	7.306	533.56
15	68.13	0.31	7.306	432.10
30	44.53	0.31	7.306	282.42
60	27.40	0.31	7.306	173.76
120	16.24	0.31	7.306	102.99
360	6.82	0.31	7.306	43.23
720	3.90	0.31	7.306	24.71
1440	2.22	0.31	7.306	14.07
One in Five Year Storm Event				
Time	**Intensity**	**Runoff Coefficient**	**Area**	**Flow**
min	mm/hr	C	ha	L/S
5	139.57	0.31	7.306	885.19
10	107.72	0.31	7.306	683.14
15	88.40	0.31	7.306	560.64
30	58.69	0.31	7.306	372.23
60	36.32	0.31	7.306	230.33
120	21.47	0.31	7.306	136.19
360	8.89	0.31	7.306	56.40
720	5.03	0.31	7.306	31.87
1440	2.83	0.31	7.306	17.92
One in Ten Year Storm Event				
Time	**Intensity**	**Runoff Coefficient**	**Area**	**Flow**
min	mm/hr	C	ha	L/S
5	157.73	0.31	7.306	1000.32
10	122.80	0.31	7.306	778.78
15	101.26	0.31	7.306	642.17
30	67.63	0.31	7.306	428.91
60	41.96	0.31	7.306	266.08
120	24.80	0.31	7.306	157.26
360	10.22	0.31	7.306	64.84
720	5.75	0.31	7.306	36.50
1440	3.22	0.31	7.306	20.43
One in Twenty-Five Year Storm Event				
Time	**Intensity**	**Runoff Coefficient**	**Area**	**Flow**
min	mm/hr	C	ha	L/S
5	182.17	0.31	7.306	1155.33
10	142.97	0.31	7.306	906.73
15	118.42	0.31	7.306	751.01
30	79.54	0.31	7.306	504.47
60	49.47	0.31	7.306	313.73
120	29.23	0.31	7.306	185.35
360	12.00	0.31	7.306	76.09
720	6.73	0.31	7.306	42.66
1440	3.75	0.31	7.306	23.77
One in Fifty Year Storm Event				

Time	Intensity	Runoff Coefficient	Area	Flow
min	mm/hr	C	ha	L/S
5	200.17	0.31	7.306	1269.51
10	157.69	0.31	7.306	1000.09
15	130.87	0.31	7.306	829.98
30	88.10	0.31	7.306	558.75
60	54.81	0.31	7.306	347.59
120	32.33	0.31	7.306	205.05
360	13.21	0.31	7.306	83.79
720	7.38	0.31	7.306	46.81
1440	4.10	0.31	7.306	25.99
One in Hundred Year Storm Event				
Time	Intensity	Runoff Coefficient	Area	Flow
min	mm/hr	C	ha	L/S
5	218.23	0.31	7.306	1384.04
10	172.68	0.31	7.306	1095.13
15	143.67	0.31	7.306	911.18
30	97.06	0.31	7.306	615.58
60	60.50	0.31	7.306	383.67
120	35.70	0.31	7.306	226.42
360	14.57	0.31	7.306	92.40
720	8.13	0.31	7.306	51.53
1440	4.50	0.31	7.306	28.56

7.5 Post-Development Runoff and Storage Calculations

Post-development runoff and detention storage requirements were estimated using the Rational Method and a screening-level rectangular storage approach, based on a constant allowable discharge rate corresponding to the governing storm event. For post-development detention analysis, a conservative functional-level outlet control rate of 6 L/s has been applied for storage estimation purposes; final allowable release rate and outlet sizing will be confirmed with the City of Windsor at the Site Plan stage.

For functional planning purposes, a post-development composite runoff coefficient of C = 0.70 has been adopted. This value is considered conservative and appropriate at this stage, reflecting a mixed-use development consisting primarily of roof areas, paved surfaces, and landscaped areas.

The selected coefficient provides a reasonable screening-level estimate of peak runoff and will be refined at the detailed design stage, following confirmation of final grading, surface coverage, and drainage patterns.

7.5.1 Post-Development Runoff Coefficient Calculation

Location	m^2	ha
Proposed Landscaping green area	24815.00	2.48
Gravel Area	0.00	0.00
Proposed Building area	17654.00	1.77
Proposed Asphalt Area	30592.00	3.06
Total Area	73061.00	7.31

7.5.2 Post-Development Runoff and Storage Calculations

$$\textbf{Flow}\left(\frac{\textbf{l}}{\textbf{s}}\right) = \boldsymbol{Time}\ (in\ Sec) * \boldsymbol{Intensity} * \boldsymbol{Runoff\ Coefficient}$$

One in Two Year Storm Event for Post-Development							
Time	Intensity	Runoff Coeff	Area	Flow	Discharge	Storage Flow	Storage
min	mm/hr	C	ha	L/S	L/S	L/S	m3

5	155.49	0.70	7.31	2193.99	6.00	2187.99	656.40
10	116.94	0.70	7.31	1650.06	6.00	1644.06	986.43
15	94.70	0.70	7.31	1336.30	6.00	1330.30	1197.27
30	61.90	0.70	7.31	873.41	6.00	867.41	1561.33
60	38.08	0.70	7.31	537.37	6.00	531.37	1912.95
120	22.57	0.70	7.31	318.49	6.00	312.49	2249.92
360	9.47	0.70	7.31	133.69	6.00	127.69	2758.17
720	5.42	0.70	7.31	76.43	6.00	70.43	3042.63
1440	3.08	0.70	7.31	43.53	6.00	37.53	3242.19
One in Five Year Storm Event for Post-Development							
Time	**Intensity**	**Runoff Coeff**	**Area**	**Flow**	**Discharge**	**Storage Flow**	**Storage**
min	mm/hr	C	ha	L/S	L/S	L/S	m3
5	194.01	0.70	7.31	2737.50	6.00	2731.50	819.45
10	149.73	0.70	7.31	2112.66	6.00	2106.66	1263.99
15	122.88	0.70	7.31	1733.81	6.00	1727.81	1555.03
30	81.58	0.70	7.31	1151.15	6.00	1145.15	2061.27
60	50.48	0.70	7.31	712.32	6.00	706.32	2542.75
120	29.85	0.70	7.31	421.18	6.00	415.18	2989.27
360	12.36	0.70	7.31	174.42	6.00	168.42	3637.93
720	6.99	0.70	7.31	98.56	6.00	92.56	3998.66
1440	3.93	0.70	7.31	55.42	6.00	49.42	4269.69
One in Ten Year Storm Event for Post-Development							
Time	**Intensity**	**Runoff Coeff**	**Area**	**Flow**	**Discharge**	**Storage Flow**	**Storage**
min	mm/hr	C	ha	L/S	L/S	L/S	m3
5	219.24	0.70	7.31	3093.54	6.00	3087.54	926.26
10	170.69	0.70	7.31	2408.42	6.00	2402.42	1441.45
15	140.75	0.70	7.31	1985.94	6.00	1979.94	1781.95
30	94.01	0.70	7.31	1326.44	6.00	1320.44	2376.79
60	58.32	0.70	7.31	822.88	6.00	816.88	2940.76
120	34.47	0.70	7.31	486.34	6.00	480.34	3458.48
360	14.21	0.70	7.31	200.53	6.00	194.53	4201.84
720	8.00	0.70	7.31	112.86	6.00	106.86	4616.53
1440	4.48	0.70	7.31	63.18	6.00	57.18	4940.39
One in Twenty Five Year Storm Event for Post-Development							
Time	**Intensity**	**Runoff Coeff**	**Area**	**Flow**	**Discharge**	**Storage Flow**	**Storage**
min	mm/hr	C	ha	L/S	L/S	L/S	m3
5	253.22	0.70	7.31	3572.92	6.00	3566.92	1070.08
10	198.73	0.70	7.31	2804.11	6.00	2798.11	1678.87
15	164.60	0.70	7.31	2322.53	6.00	2316.53	2084.88
30	110.57	0.70	7.31	1560.10	6.00	1554.10	2797.39
60	68.76	0.70	7.31	970.23	6.00	964.23	3471.23
120	40.62	0.70	7.31	573.20	6.00	567.20	4083.84
360	16.68	0.70	7.31	235.31	6.00	229.31	4953.17
720	9.35	0.70	7.31	131.92	6.00	125.92	5439.63
1440	5.21	0.70	7.31	73.52	6.00	67.52	5833.91
One in Fifty Year Storm Event for Post-Development							
Time	**Intensity**	**Runoff Coeff**	**Area**	**Flow**	**Discharge**	**Storage Flow**	**Storage**
min	mm/hr	C	ha	L/S	L/S	L/S	m3
5	278.24	0.70	7.31	3926.01	6.00	3920.01	1176.00
10	219.19	0.70	7.31	3092.82	6.00	3086.82	1852.09
15	181.91	0.70	7.31	2566.75	6.00	2560.75	2304.67
30	122.46	0.70	7.31	1727.97	6.00	1721.97	3099.55
60	76.18	0.70	7.31	1074.93	6.00	1068.93	3848.13
120	44.94	0.70	7.31	634.12	6.00	628.12	4522.49
360	18.37	0.70	7.31	259.14	6.00	253.14	5467.79
720	10.26	0.70	7.31	144.75	6.00	138.75	5993.96
1440	5.70	0.70	7.31	80.36	6.00	74.36	6424.78
One in Hundred Year Storm Event for Post-Development							

Time	Intensity	Runoff Coeff	Area	Flow	Discharge	Storage Flow	Storage
min	mm/hr	C	ha	L/S	L/S	L/S	m3
5	303.34	0.70	7.31	4280.20	6.00	4274.20	1282.26
10	240.02	0.70	7.31	3386.73	6.00	3380.73	2028.44
15	199.70	0.70	7.31	2817.86	6.00	2811.86	2530.67
30	134.92	0.70	7.31	1903.73	6.00	1897.73	3415.91
60	84.09	0.70	7.31	1186.53	6.00	1180.53	4249.90
120	49.63	0.70	7.31	700.23	6.00	694.23	4998.46
360	20.25	0.70	7.31	285.75	6.00	279.75	6042.52
720	11.29	0.70	7.31	159.36	6.00	153.36	6625.14
1440	6.26	0.70	7.31	88.31	6.00	82.31	7111.69

7.6 Storage Requirements Criteria and Calculations

Storage volumes were estimated using a screening-level rectangular storage method based on peak inflow rates calculated using the Rational Method and a constant allowable discharge rate corresponding to the governing storm event.

This approach provides a conservative, order-of-magnitude estimate of detention storage requirements suitable for functional planning and does not represent final facility sizing or configuration. Final storage configuration, hydraulic routing, outlet control sizing, and performance verification will be completed at the Site Plan and detailed design stage, in accordance with WERSM.

7.7 Comparison of Pre- and Post-Development Runoff

Comparison Between Pre- and Post-Development Storm Runoff (10 min)			
	Pre Dev Runoff	**Post Dev Runoff**	**Storage Volume**
	L/S	**L/S**	**m^3**
One in Two Years	533.56	1650.06	3242.19
One in Five Years	683.14	2112.66	4269.69
One in Ten Years	778.78	2408.42	4940.39
One in Twenty-Five Years	906.73	2804.11	5833.91
One in Fifty Years	1000.09	3092.82	6424.78
One in a Hundred Years	**1095.13**	**3386.73**	**7111.69**

The comparison of pre- and post-development runoff rates demonstrates the need for on-site detention storage to manage increased runoff resulting from site redevelopment. Storage volumes associated with storm events greater than the 2-year storm are provided for major system screening purposes only.

7.8 Summary of Results

Summary	
Governing minor system control event	2-Year Storm
Pre-development 2-year runoff rate	533.56 L/s
Post-development 2-year runoff rate (uncontrolled)	1650.06 L/s
Estimated 2-year detention storage requirement	1116.50 m^3
100 Year Pre-Development Runoff	1095.13 L/s
100 Year Post-Development Runoff	3386.73 L/s
Storage Volume Required	7111.69 m^3

7.9 Water Quality Control Strategy

Stormwater quantity control for the proposed development has been evaluated in accordance with City of Windsor requirements and the Windsor/Essex Region Stormwater Management Standards Manual (WERSM) at a functional planning level.

For functional planning purposes, the 2-year storm event has been identified as the governing minor system control event, consistent with typical City practice, subject to confirmation at the Site Plan stage. Post-development discharge is anticipated to be restricted to the pre-development 2-year peak runoff rate through on-site detention measures.

Minor system detention storage is intended to be provided primarily through underground storage components within the site. Surface ponding and overland flow conveyance are considered part of the major drainage system and are intended to safely accommodate larger storm events, including the 5-year and 100-year storms, without adverse impacts to adjacent properties or downstream infrastructure. Underground storage components may also contribute to overall system performance during major storm events, as applicable.

For post-development detention analysis, a conservative functional-level outlet control rate of 6 L/s has been applied for storage estimation purposes. Final allowable release rate and outlet control sizing will be confirmed with the City of Windsor at the Site Plan and detailed design stage, following confirmation of downstream conditions and tailwater influences.

7.10 Water Quality Control

Stormwater quality control for the proposed development has been considered at a functional planning level in accordance with the Windsor/Essex Region Stormwater Management Standards Manual (WERSM) and City of Windsor requirements.

At the zoning stage, stormwater quality control is addressed conceptually to confirm that appropriate measures can be implemented at detailed design. The proposed development will incorporate source, conveyance, and end-of-pipe stormwater quality controls, as required, to mitigate potential impacts on downstream municipal infrastructure and receiving systems.

Stormwater runoff from paved parking areas, drive aisles, and access roads will be directed through appropriate oil and grit separation (OGS) measures or equivalent quality control devices prior to discharge to the municipal storm sewer system. The selection, sizing, and configuration of stormwater quality control measures will be finalized at the Site Plan and detailed design stage, based on contributing drainage areas, hydraulic conditions, maintenance access requirements, and applicable City standards.

Landscaped and pervious areas within the site will also contribute to stormwater quality management by providing infiltration, filtration, and runoff volume reduction benefits, where feasible.

Detailed stormwater quality control design, including confirmation of treatment requirements, device selection, sizing methodology, maintenance provisions, and compliance with City of Windsor criteria, will be completed at the Site Plan approval stage, in consultation with the City of Windsor and relevant approval agencies.

8 Conclusions

Based on this functional-level Stormwater Management assessment, the following conclusions are provided:

- For functional planning purposes, post-development stormwater runoff is anticipated to be controllable to the pre-development 2-year peak runoff rate, consistent with typical City of Windsor minor system quantity control practice, subject to confirmation by the City at the Site Plan stage.
- The estimated on-site detention storage requirement for the 2-year minor system control event can be conceptually accommodated through underground storage components, while temporary surface ponding and overland flow conveyance are reserved for major system events, subject to confirmation and refinement during detailed design.
- Major storm events, including the 5-year and 100-year storms, as well as climate change considerations (Urban Stress Test), are anticipated to be safely accommodated through the major drainage system, including defined overland flow routes and temporary on-site storage, without adverse impacts to adjacent properties or downstream infrastructure. Detailed evaluation of major system performance and climate change vulnerability will be completed at the Site Plan and detailed design stage.
- The proposed stormwater management approach is technically feasible at a functional planning level and appropriate to support planning and zoning approvals. The development may proceed to detailed design, at which time grading refinement, hydraulic routing and modelling, outlet control sizing, confirmation of tailwater conditions, and regulatory approvals will be completed to the satisfaction of the City of Windsor and applicable approval agencies.

9 Limitations and Assumptions

This Stormwater Management Report has been prepared at a functional planning level and is subject to the following assumptions and limitations:

- Stormwater runoff rates and preliminary storage requirements have been estimated using screening-level methods, including the Rational Method.
- Portions of the site are located within a mapped flood-prone area. Flood-related constraints and downstream tailwater conditions have been acknowledged conceptually and will be confirmed during detailed design in consultation with the City of Windsor and ERCA.
- Detailed hydraulic routing, outlet sizing, grading refinement, and major system conveyance have not been completed at this stage and will be finalized during detailed design.

Final stormwater management design will be subject to City of Windsor review and approval, as well as any required approvals from applicable agencies

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Third-party Disclaimer

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